ROTATIONAL SPECTROSCOPY IN SUPPORT OF MICROWAVE LIMB SOUNDING AND UPPER ATMOSPHERIC RESEARCH

Edward A. Cohen
Jet Propulsion Laboratory
California Institute of Technology
Pasadena, CA 91109-8099, USA

The Microwave Limb Sounder (MLS) experiments measure naturally-occurring microwave thermal emission from the limb of Earth's atmosphere to remotely sense vertical profiles of selected atmospheric gases, temperature and pressure. The first MLS experiment in space is on NASA's Upper Atmosphere Research Satellite (UARS) with its major objective to improve understanding of stratospheric ozone, especially ozone depletion due to chlorine chemistry. The next-generation MLS, under development for the AURA Mission of NASA's Earth Observing System (EOS), addresses a broader range of global change issues and is scheduled for launch in 2002. Aircraft and balloon versions of the MLS experiments were also developed prior to the space experiments, and are still continuing. UARS MLS atmospheric observations started on 19 September 1991, within one week of launch, and are still continuing. The data are publicly available through the Distributed Active Archive Center of the NASA Goddard Space Flight Center and through the British Atmospheric Data Center.

Several of the accomplishments of the UARS MLS program will be discussed and some of the objectives of the MLS to be flown on the AURA Mission will be presented. Particular attention will be paid to the MLS observations of chlorine monoxide and ozone and their contribution to our understanding the ozone depletion problem.

The MLS program depends upon reliable laboratory measurements. In the past our laboratory program has provided precise positions, strengths and air broadened linewidths of ClO and O_3 as well as a database of the rotational spectra of most of the species which may be observable. As the capabilities of the MLS instruments have been extended into the THz region, additional laboratory support is required. The MLS for the AURA mission will be observing many more molecules over a wider frequency range and greater vertical distribution than earlier instruments. The spectroscopy requirements of the AURA MLS program will be presented as well as an overview of the methods we are using to meet these needs.

During the course of our investigations in support of MLS we have observed the spectra of a number of halogen oxides and related compounds. The analyses of these spectra have contributed not only positions and strengths, but also important structural information for this important class of compounds that may be of significance in upper atmospheric chemistry. Some examples of recent results will be shown.